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Levitation properties of magnetic attraction type levitation system having HTS bulk and HTS racetrack magnet

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We have been studying a magnetic levitation system using a magnetic shielding effect of HTS bulks. The analysis method is numerical simulation utilizing the 2D and 3D finite element method software, COMSOL Multiphysics. This system consists of three items which are an iron rail, the HTS bulks, and the magnet. In the former work using a permanent magnet, the peak levitation force was smaller than 1 kilogram. To increase a magnetic field generated by the magnet, we replaced the permanent magnet to a HTS solenoid magnet. In the modified system, the peak levitation force increased and was 2 or 3 kg. In the present study, we designed a racetrack magnet whose volume were same as the solenoid magnet's volume, and changed the solenoid magnet to the racetrack magnet in the levitation system. This change makes the field generated by the magnet reach effectively to the rail. According to the analytical results, the levitation force using the racetrack magnet increased by a few percent compared with that using the solenoid magnet. Next, we extended the strait section in the racetrack magnet. From the simulation results using the long racetrack magnet, the levitation force strongly increased and was approximately 20 kg. We think that the racetrack magnet is effective to gain the large levitation force in this levitation system.

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